

JPL Multimission Instrument Processing Laboratory (MIPL)

Mastcam Stereo Analysis and Mosaics (MSAM)

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What is MSAM?

JPL Multimission Instrument Processing Laboratory (MIPL)

- **New PDART task (Planetary Data Archive, Restoration and Tools)**
 - Part of NASA ROSES (Research Opportunities in Space and Earth Science)
- **Starting this month (June 2017)**
- **Run by personnel from JPL's Multimission Image Processing Lab (MIPL)**
- **This presentation introduces MSAM to the planetary science community**
 - We solicit feedback on your specific needs



What will MSAM do?

JPL Multimission Instrument Processing Laboratory (MIPL)

- **Create higher-order data sets using all available MSL Mastcam data**
 - Stereo processing
 - Terrain meshes
 - Three types of mosaics
 - Mastcam-Navcam coregistered mosaics
 - Stereo mosaics
 - Orthorectified mosaics and DEM's
- **Processing all data up to PDS Release 11**
 - May go farther if budget allows
- **Uses the same software and pipeline that MIPL/OPGS uses in operations**
 - Well validated and robust
- **Data Availability expected Aug 2018**
 - All dates subject to change
- **Results will be delivered to PDS**



Stereo Products

JPL Multimission Instrument Processing Laboratory (MIPL)

- **Process all ~11,900 Mastcam stereo pairs (as of PDS Release 11)**
- **Products created:**
 - Decompressed images
 - De-Bayered (demosaicked) images
 - Disparity maps
 - XYZ point clouds
 - Surface normals
 - Range maps
 - Slope maps
 - Slope aspects
 - Stereo anaglyphs
 - Range error estimates
- **These all match what MIPL/OPGS produces for the Navcams**
- **The following examples are Marsviewer visualizations**
 - The actual data products are quantitative images (e.g. DN=XYZ value)



Stereo Product Examples

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Original image (sol 735)

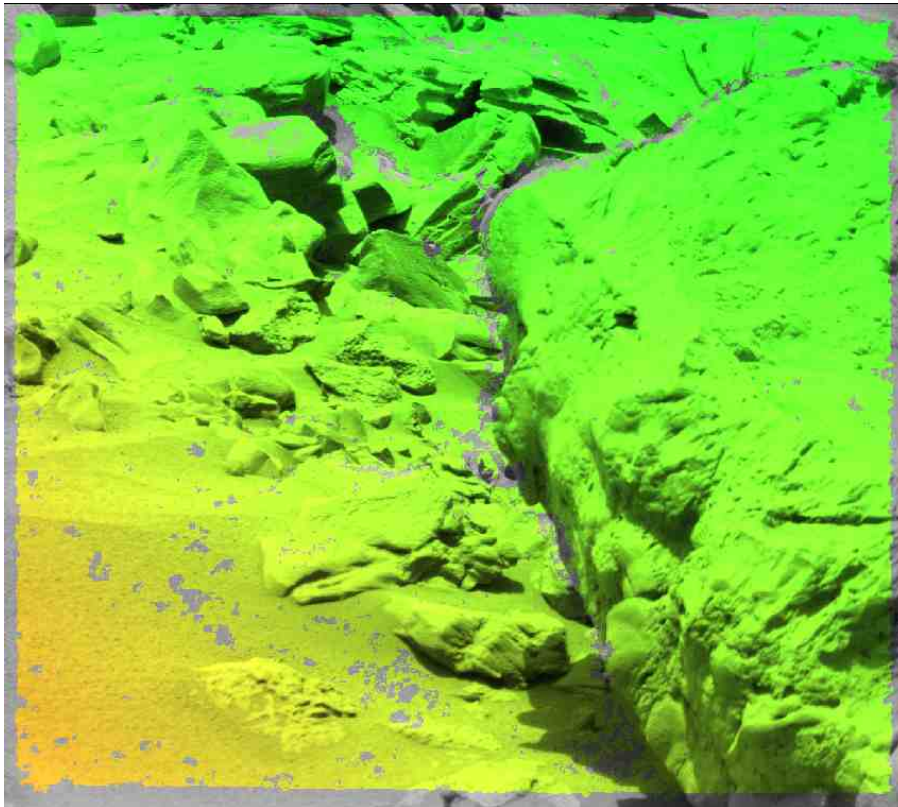


Decompanded (linear color space)

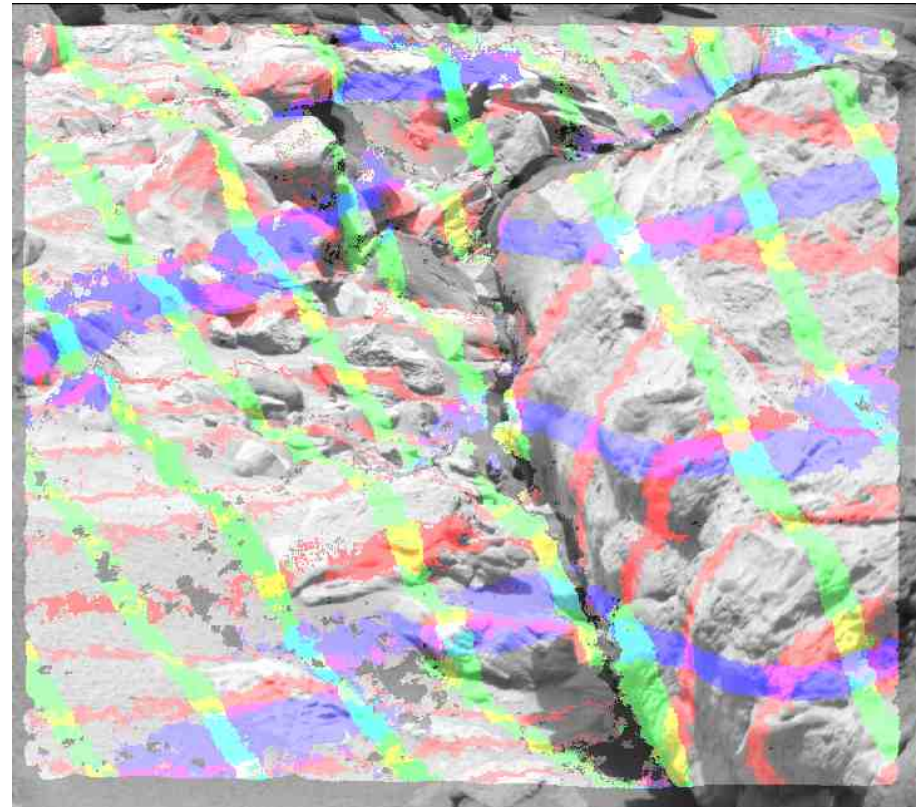


Stereo Product Examples (cont)

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Stereo Disparity

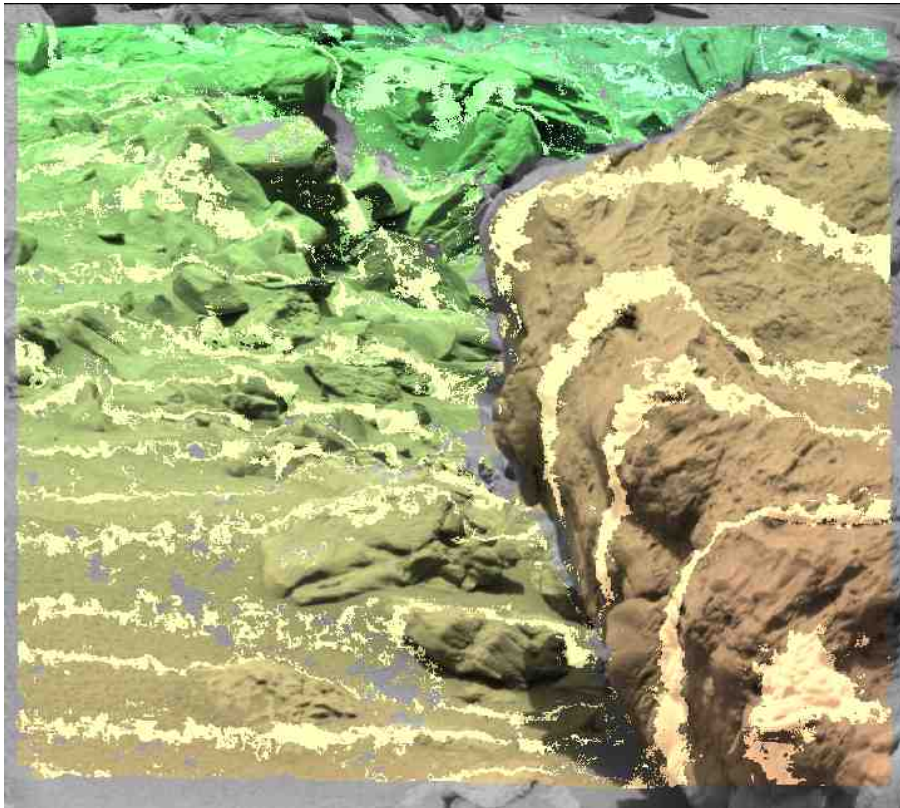


XYZ data (contours at 10cm:
red=constant X, green=constant Y,
blue=constant Z)

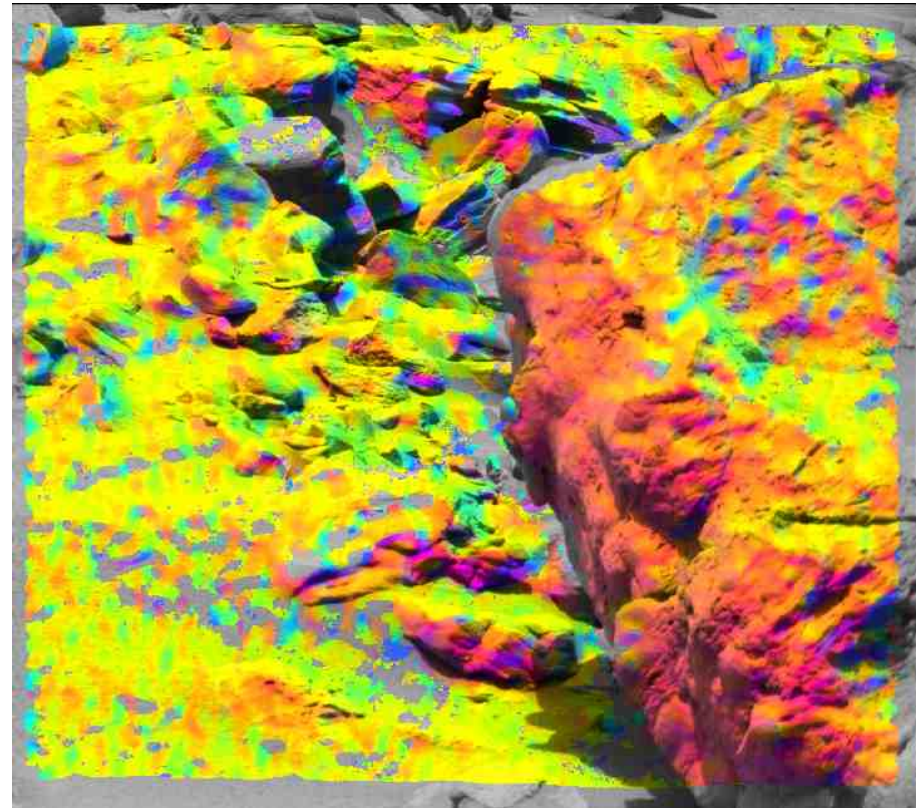


Stereo Product Examples (cont)

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Range (contours at 10cm)

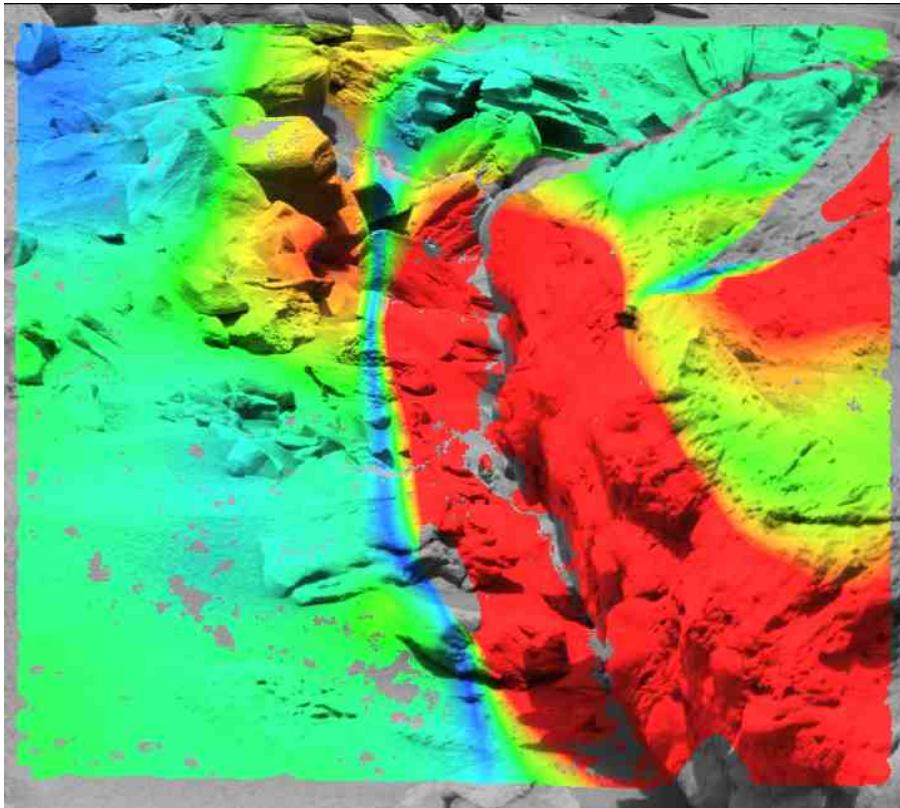


Surface normal

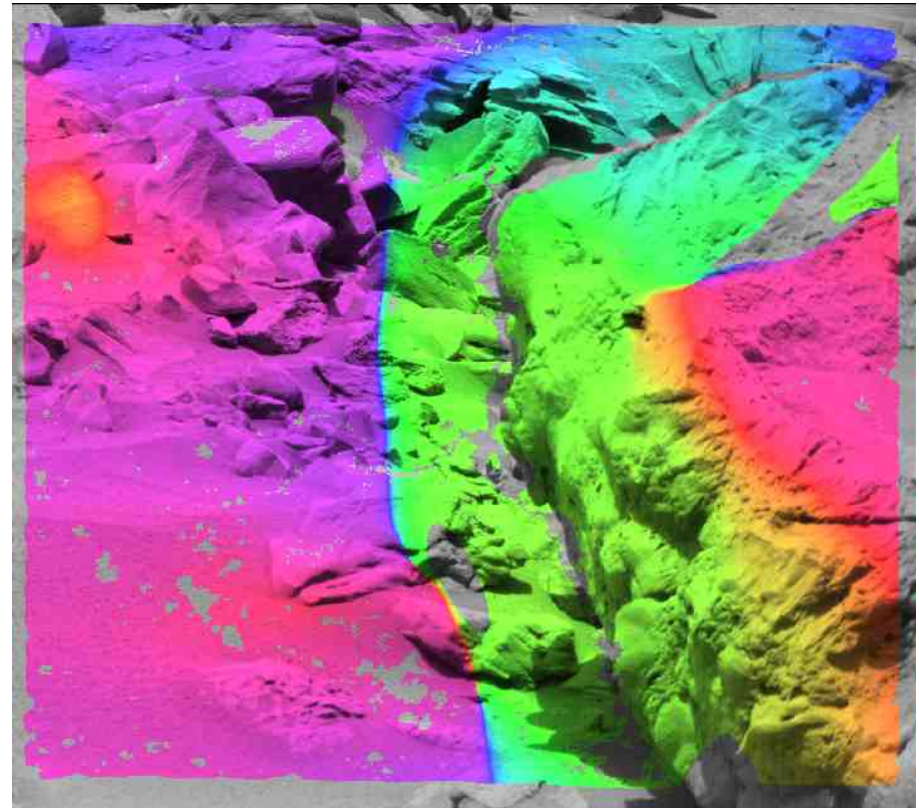


Stereo Product Examples (cont)

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Slope



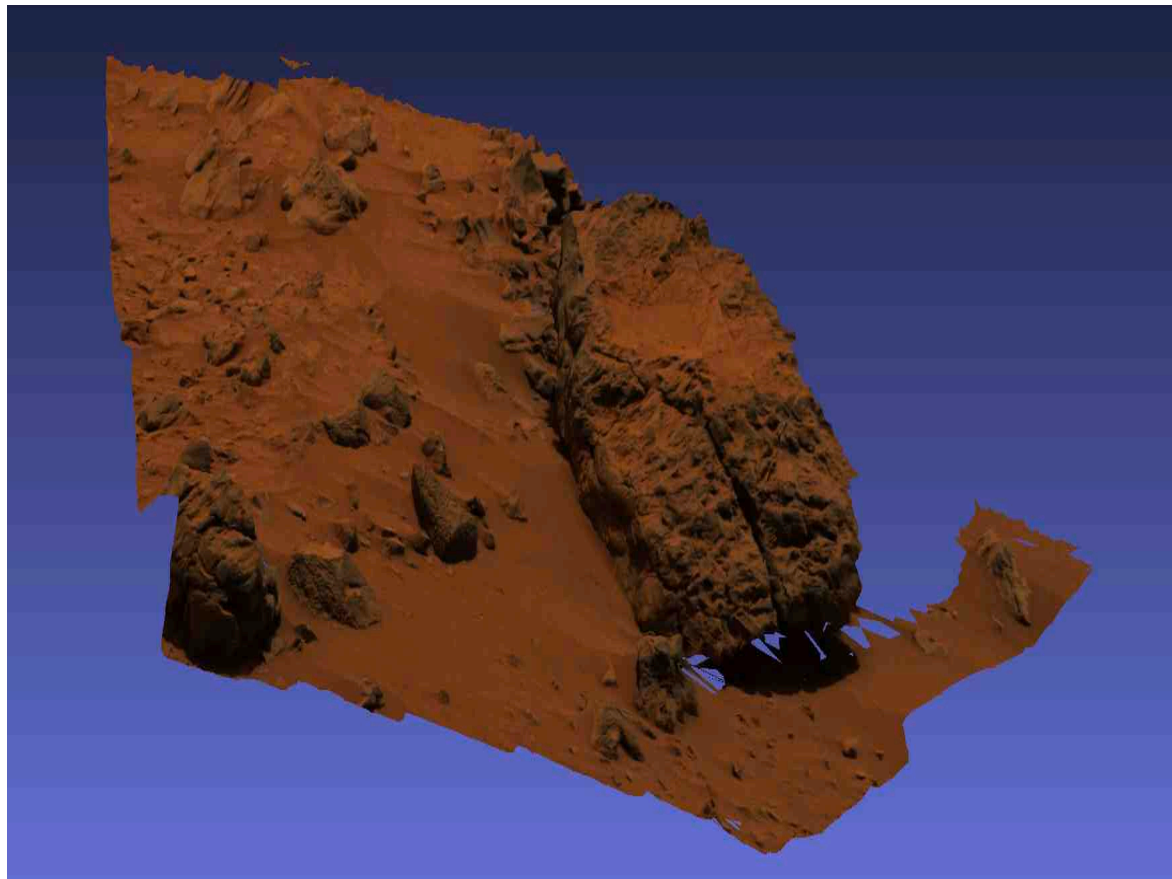
Slope Aspect (heading)



Terrain Meshes

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- **Terrain meshes will be made in OBJ format**
 - Widely accepted by most 3D visualization programs (e.g. MeshLab)
 - We think we have figured out how to deliver these in a PDS-4 compliant way





Mastcam-Navcam coregistered mosaics

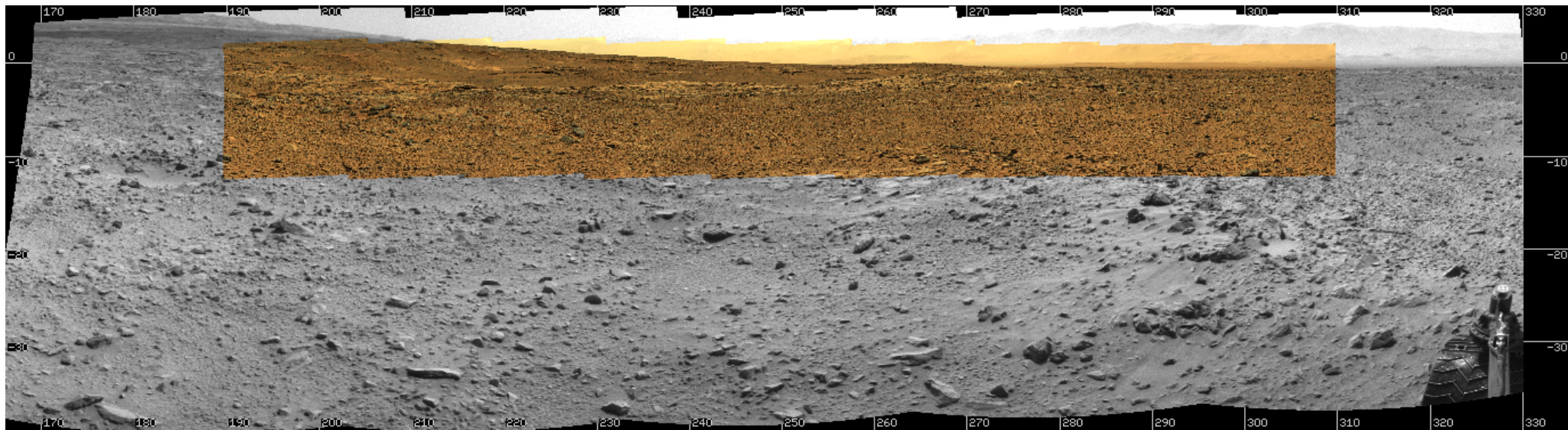
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- **Combination of Mastcam and Navcam from the same location**
 - Including non-stereo images
- **Cylindrical projection**
- **Navcam frames serve as context images for Mastcam**
- **Frames will be coregistered to reduce geometric seams**
- **Question for the community:**
 - How much Navcam context should we include?
 - May be space-prohibitive to do a full 360 at each location



Mastcam-Navcam overview

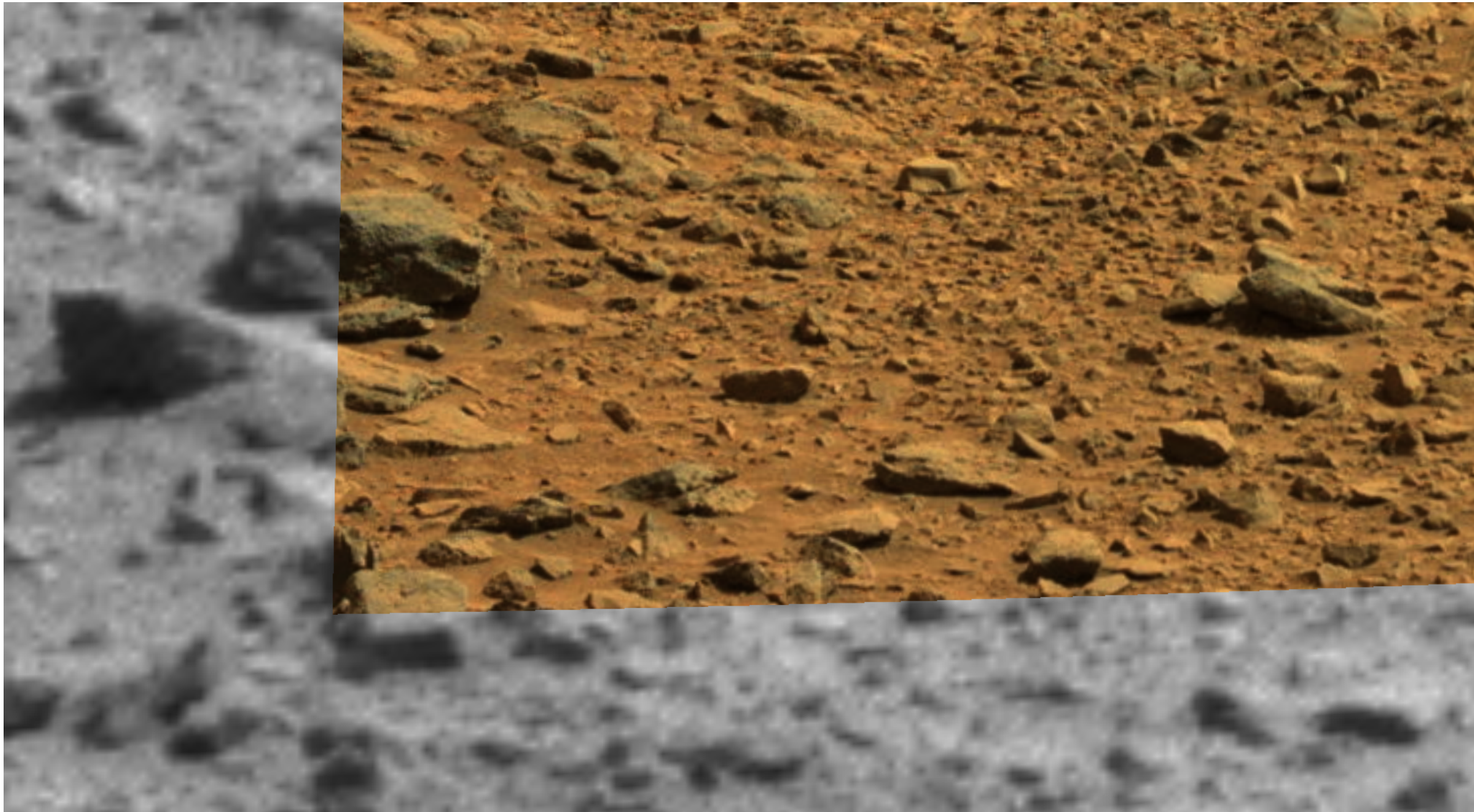
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Mastcam-Navcam closeup

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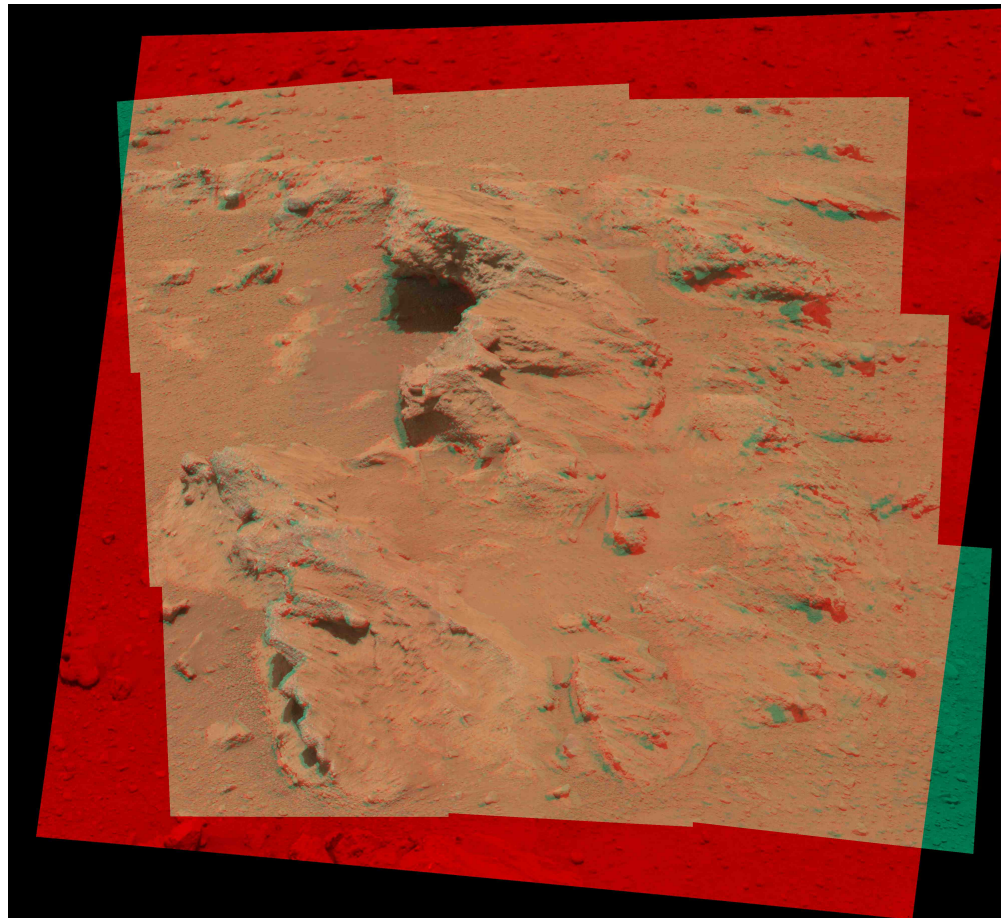




Stereo Mosaics

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- **Made from as many data sets as possible**
 - Some frames not conducive to stereo viewing
- **Color stereo and red/blue anaglyph**

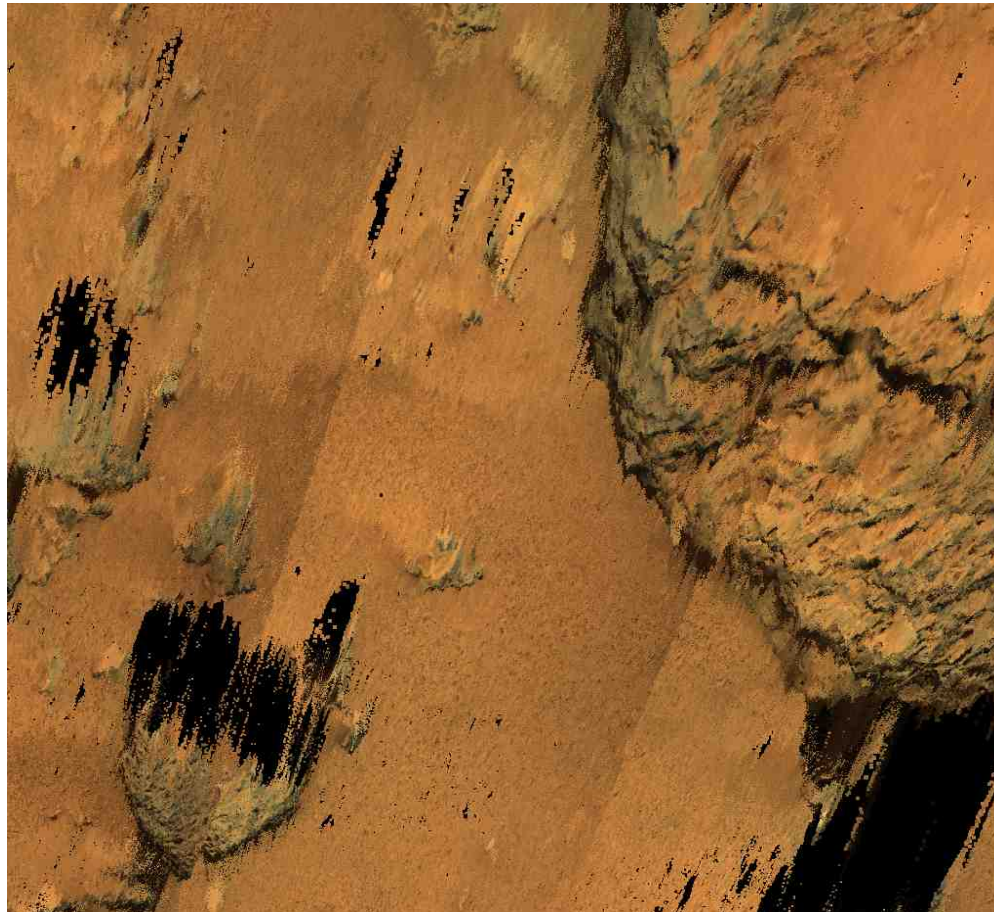




Orthorectified Mosaics and DEM's

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- **Orthorectified mosaics provide a “true” overhead view of the terrain**
 - Uses XYZ data to remove layover effects and parallax distortion
- **Coregistered DEM's provide elevation**





Radiometric Correction

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- **Jim Bell (ASU) has an independent PDART (also starting now) to do radiometric correction of Mastcam data**
 - We plan to work together to incorporate these results into MSAM mosaics and meshes
 - Radiometric correction does not affect stereo processing



Results will be delivered to PDS

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- **PDS 4 format**
- **Also compatible with the OPGS-produced Navcam archive for MSL**
 - Same dual-label ODL/VICAR files
 - PDS 4 detached labels
- **Question for the community:**
 - Do we need to include a PDS 3 detached label as well?
 - Would exactly match PDS 3 format but not be “official” PDS 3 product
 - PDS no longer accepts new kinds of PDS 3 data
 - ODL and VICAR labels may be sufficient



PDS Peer Review

JPL Multimission Instrument Processing Laboratory (MIPL)

- **PDS Peer Review currently planned for Dec 2017-Feb 2018**
 - Dates may change!
- **We will be looking for peer reviewers**
- **Question for the community:**
 - Would you like to participate in the Peer Review?



Feedback

JPL Multimission Instrument Processing Laboratory (MIPL)

- **We welcome comments, questions, suggestions, or concerns from the planetary data community**
 - That's the entire point of this talk
- **Please contact the lead author and PI:**
Bob.Deen@jpl.nasa.gov
- **Full Team:**
 - Robert Deen (JPL/MIPL), PI
 - Justin Maki (JPL/MIPL), Co-I, validation
 - Stirling Algermissen (JPL/MIPL), Co-I, PDS generation
 - Hallie Abarca (JPL/MIPL), Co-I, mosaic generation
 - Nicholas Ruoff (JPL/MIPL), Co-I, stereo pipeline
 - Adrian Tinio (JPL/MIPL), pipeline
 - Steve Levoe (JPL/MIPL), PDS label generation
 - Costin Radulescu (JPL/MIPL), PDS integration
 - Amy Culver (JPL/MIPL), PDS integration
 - Nicholas Toole (JPL/MIPL), Marsviewer integration
 - Ray Arvidson (Washington University), Collaborator, science & PDS integration
 - Ken Herkenhoff (USGS), Collaborator, science consultant